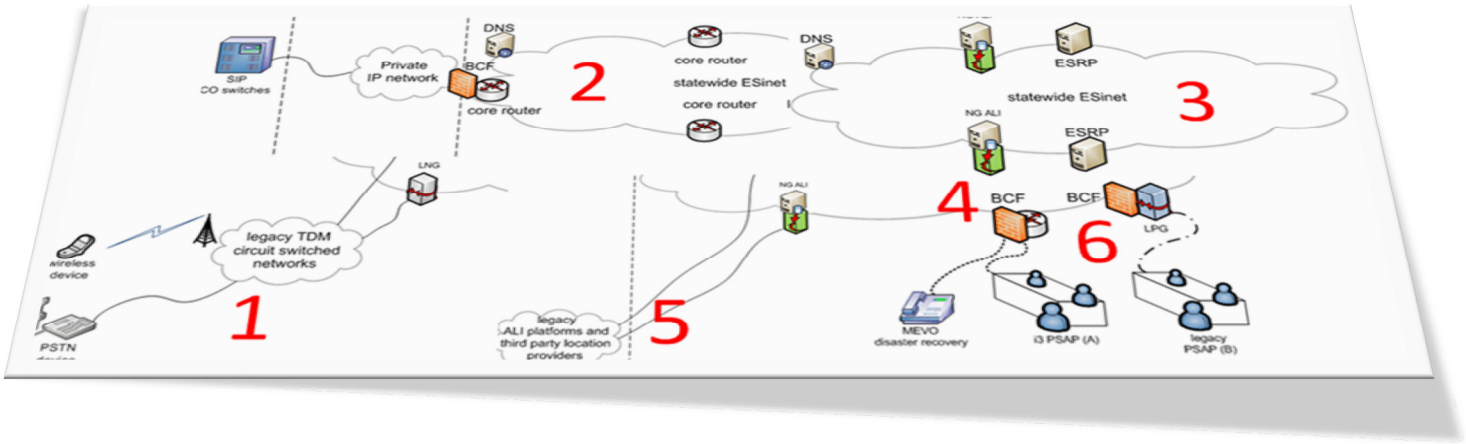
IN911 SYSTEM SYSTEM TEST AND ANALYSIS REPORT



MARCH 2013

Prepared by

911 Authority
Connecting Public Safety with Technology

TABLE OF CONTENTS

EXECUTIVE SUMMARY

911 Authority was retained by the Indiana Statewide 911 Board (the Board) to direct the execution of a comprehensive test of the IN911 System, to analyze the results of the testing and provide an assessment of the current status of the IN911 System, its operation and the activities that support the IN911 System.

No 9-1-1 calls were negatively impacted as a result of the system test. They may have been delivered via an alternate route but all calls encountered during the system test were delivered as designed.

This report is not a technical analysis of the system testing of the IN911 System. It is a document produced for the use of the Indiana Statewide 911 Board and is therefore simplified and informational in nature.

REQUEST OF THE BOARD

- ✓ Identify System Test Guidelines, Goals and Objectives
- ✓ Develop and refine comprehensive test plans to test the system and its components to guide the work of INdigital, the IN911 System service provider
- ✓ Develop a testing schedule that could be integrated into the scheduled changes being implemented as part of the identified remediation following the 10-1-12 outage
- ✓ Oversee and assist with the execution and analysis of the IN911 System test
- ✓ Oversee and participate in the testing of 20 distinctive IN911 Functional Elements
- ✓ Oversee and participate in the execution of 141 individual tests of the system
- ✓ Review and analyze the results of the testing
- ✓ Draft a findings report to provide an analysis of the IN911 System and its components

THE OBJECTIVE

- ✓ Perform an end to end system test of the IN911 System (human and machine) in order to stress test the IN911 System
- ✓ Evaluate and analyze the current system, its components and the resources assigned to maintain and operate the IN911 System
- ✓ Prove the system is in sound operating condition and that it can be restored to that condition with confidence and in a timely manner
- ✓ Develop a proactive methodology for identifying potential issues that could lead to a future outage and identify a process to minimize the effect of failure of the IN911 System or its components

THE RESULTS

- ✓ Comprehensive, end to end system test largely complete
- ✓ Standards of operation identified, developed and implemented
- ✓ Reduction of fault zones (that could cause an impact or failure)
- ✓ Increased system familiarity and understanding by INdigital support staff
- ✓ An ongoing operational maintenance and testing plan developed and implemented
- ✓ Processes improved and effective system management procedures developed and implemented
- ✓ Reexamination of the as built vs the as designed system
- ✓ Identification of unexpected configurations and operations that required changes
- ✓ Modifications of the IN911 System design for improved reliability and survivability

FINDINGS AND CONCLUSIONS

- The IN911 System test itself was very successful in meeting its objectives and establishing a better operational foundation for the IN911 System.
- Inconsistent configurations were identified and corrected, standardization was accomplished, and a refreshed and expanded understanding of the operation of the IN911 System was achieved. Overall, this was a very successful effort.
- It was good to step back from the day to day operation of the system and look at it through the different lens that system testing provided. This precipitated new thoughts and ideas for resilient design, redundancy considerations as well as a renewed focus on the restoration and failure containment of future outages.
- 911 Authority found that the IN911 System's ability to operate with impairment has improved and its design principals were validated by the IN911 System testing.
- 911 Authority found during this period of analysis that the changes made to the system over time, are consistent with the adaptation to emerging public safety technologies and standards like the NENA 08-003 i3 Standard and further that the IN911 System is as current, as a system like this should be.
- 911 Authority found that the IN911 System is in excellent operating condition and was improved by this testing. The system operated as expected and the implementation of structured stress testing for the functional elements has played a key role in achieving the Board's goal to improve public safety.
- 911 Authority has a high degree of confidence in the health and welfare of the IN911 System, that does not mean it won't fail or have outages, it will, but the system itself as well as those who support its operation are better prepared to keep it in operation and restore it to operation in a timely manner should an outage occur.

SYSTEM TEST OVERVIEW

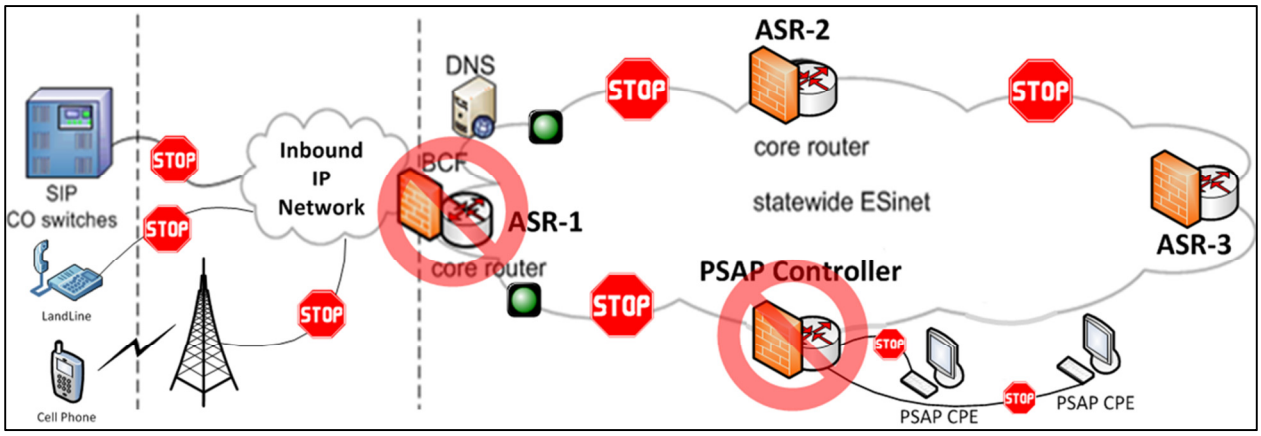


Figure 1 – Depiction of 10-1-2012 Outage, and a Test Scenario for the IN911 System Test

THE OBJECTIVE

The objective of the IN911 System test was to purposefully recreate scenarios similar to the outage of the October 1, 2012 . That incident is depicted in Figure 1 above. The goal was to see how the system, comprised of both human and machine elements, reacted to future incidents.

This required the development of an extensive test and contingency plan that would both stress the IN911 System, and minimally impact the delivery of legitimate 9-1-1 calls. In other words, we could not impact live 9-1-1 call traffic as the system test was executed.

The overall objective of the system test was to monitor, record and understand how each of these major functional areas of the IN911 System listed below worked and operated when challenged by failure or outage.

- Call delivery and core functions
- Network routing
- Disaster recovery
- Restoration

An additional objective was to identify any areas within the system that were operating as built, but not as designed and reconfigure or redesign these components to an industry standard design.

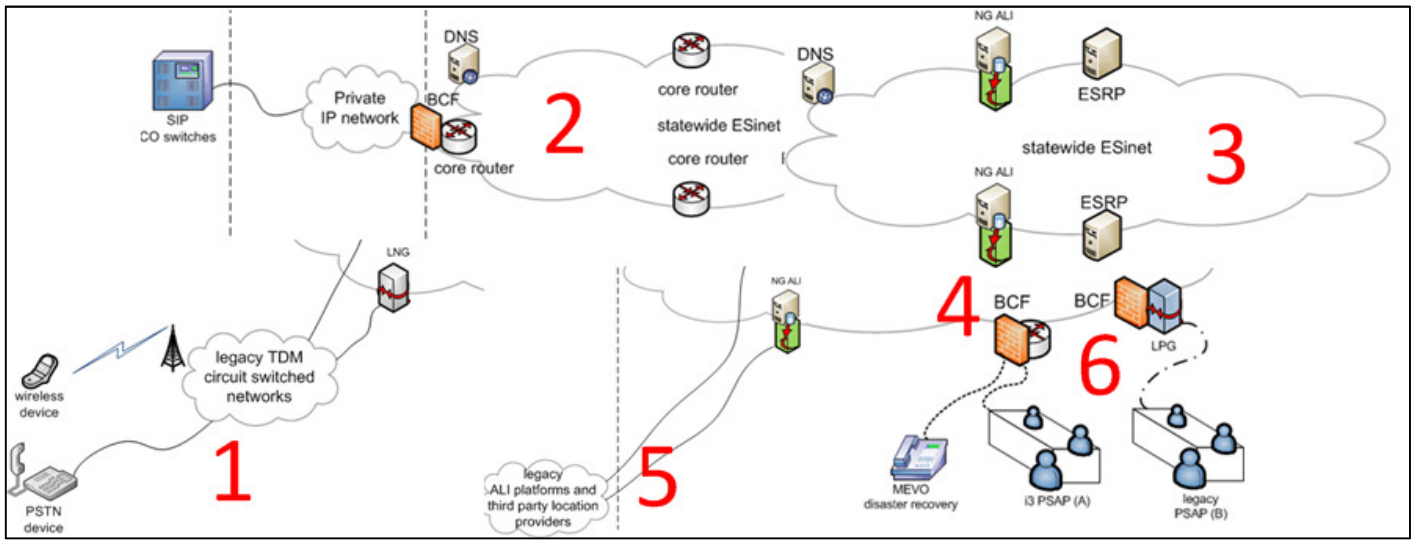


Figure 2 IN911 System Test Components

THE TEST PLAN – 6 MAJOR COMPONENTS

Six major components of the system were tested both individually as well as in the testing of other components. The six major tested elements are displayed in the figure above. The six areas are:

1. **Carrier Connections Testing** – this is testing of the connections to IN911 for the purposes of receiving 9-1-1 calls from the originating service providers. This is the testing of inbound 9-1-1 call traffic from the commercial carriers including AT&T, Verizon, Sprint, etc. The primary testing consisted of disrupting connectivity and presenting test calls to validate that the alternate call paths worked properly.

2. **Core routing and (ESinet) testing** - this is testing of the IN911 System itself, how it routes traffic, how it manages call flow around outages etc. This is testing of the network functions and capabilities. This function was addionally tested as part of every other system test performed. The testing consisted of shutting down individual pieces of equipment and observing the routing of call traffic around the components that were disabled, while ensuring there were no live 9-1-1 call processing outages.

3. **Call Content processing testing** – call content processing means routing voice and non-voice communication from the public caller to the PSAP. This testing also tests the handling of the data and information associated with a 9-1-1 call. Voice quality, the ALI record, rebids, ESN assignment, transfers etc. were included in this category of testing. Testing consisted of disrupting connectivity as well as the functional testing of individual elements.

4. **Legacy PSAP gateway (a/k/a LPG) testing** – this tested the interaction of the IN911 System after a call was routed via IN911 and delivered to the PSAP call taking equipment or the call was handed back to another 9-1-1 system service provider's network for final delivery to the PSAP. This tested the outbound

side of the IN911 System. Disruptive connectivity testing and alternate path routing were the method of testing for this element

5. **ALi / NG ALi legacy database testing** – this testing ensured the delivery of ALI and location information associated with a 9-1-1 call. This associated data is delivered via a separate data network from the 9-1-1 call itself. This test also tested the data used by the system to make routing decisions. Disruptive connectivity testing, functional operation and data integrity were the testing focus for this element.

6. **PSAP call taking equipment and configuration testing** – this tested the systems INdigital uses to serve PSAPs which answer and process calls delivered via the IN911 System. Disruptive connectivity testing, alternate call paths and data exchange were the testing focus for this element.

SYSTEM TEST ASSUMPTIONS

The test scenarios were developed with the following assumptions, a challenge to the system would likely begin with one if not more of the events listed below;

a. Environmental - heat, physical damage, lack of AC or DC power

b. Hardware failure (physical device failure)

c. Software failure (software processing failure or impairment)

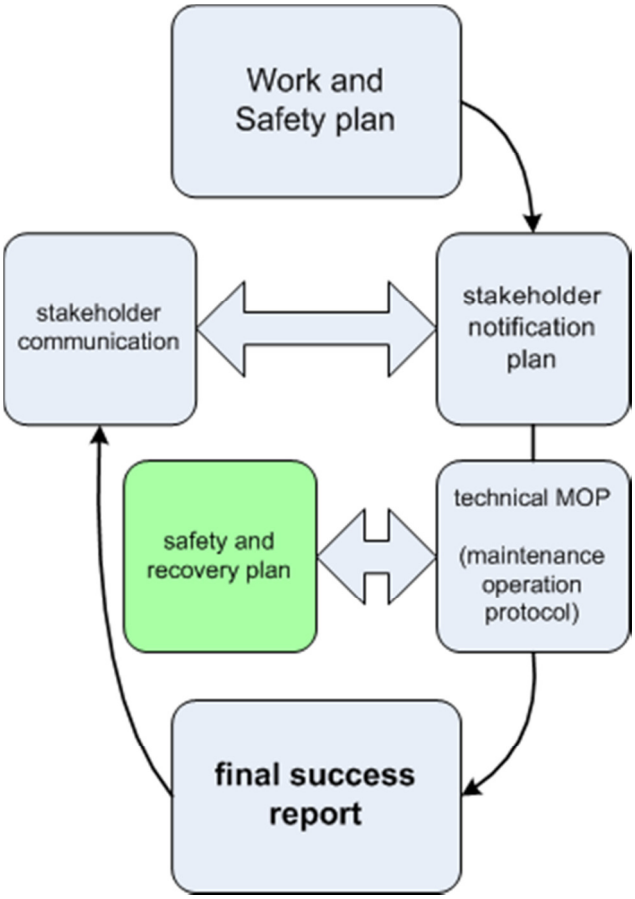
d. Unintentional technician error

-The remainder of this page is intentionally left blank-

TEST METHODOLOGY

This section will explain in some detail the methodology of the IN911 System test, how it was done, the work products developed to support it and provide some insight into the thoughtful, purposeful and logical manner by which this system test was executed.

The diagram below depicts the process flow of the system testing effort and will be examined and explained on the next few pages.



This methodology has now been adopted by INdigital for all aspects of change management to the IN911System, this includes routine system or equipment maintenance as well as equipment change outs. It doesn't happen if it doesn't follow this work flow and utilize these work protocols.

TESTING CALENDAR

A testing calendar was developed in conjunction with INdigital in order to plan out and schedule the testing of the entire system, a representation of the testing calendar is shown below.

Tue Dec 11, 2012	
Hosted CPE Controller	1 Test
IP Core - Backbone Access	19 Tests
IP Core - Backbone Router	31 Tests
Tue Dec 18, 2012	
Hosted CPE Controller	1 Test
Tue Jan 8, 2013	
ALI/NG ALI - Legacy SRDB	4 Tests
ALI/NG ALI - SeQuel database SQ	2 Tests
ALI/NG ALI Server Daemon	2 Tests
Carrier - Switches	1 Test
MEVO MV	2 Tests
IP Core - PSAP Router	10 Tests
Wed Jan 9, 2013	
Carrier - LNG	29 Tests
Tue Jan 15, 2013	
Call Content Proc - Message Engine	2 Tests
IP Core - PSAP Router	10 Tests
Wed Jan 16, 2013	
Call Content Proc - Message Engine	2 Tests
Tue Jan 22, 2013	
Call Content Proc - NG ALI	1 Test
Call Content Proc - TTY Gateway	4 Tests
IP Core - PSAP Router	10 Tests
Tue Jan 29, 2013	
IP Core - PSAP Router	10 Tests

TEST DAY ACTIVITY

Each test day noted in the calendar above generally followed the agenda shown below. There were times when a PSAP wasn't ready or a break was called due to call volumes or local events, but in general, this describes the activity that took place during each of the scheduled testing sessions..

1. Conference bridge started – participants join and establish communications
2. Distribution of test docs – the INdigital Work and Safety Plan (IWSP) is shared and reviewed for the scheduled testing
3. Briefing of test, goals and objectives –a briefing synopsis given to testing participants on what is to be tested, how the testing would be conducted, what would trigger the safety plan as well as any other discussion as necessary
4. Execute test scripts – the majority of the testing sessions was spent executing the tests themselves and ensuring the adequate system event logging was recorded and documented
5. Document the testing via logs, etc – all testing was logged and documented
6. Adjust the schedule as necessary – reschedule of any missed or delayed tests due to current circumstances (i.e. PSAP not ready, equipment configuration changes etc.)
7. Wrap up – review the testing and the results, update the IWSP document as necessary

-The remainder of this page is intentionally left blank-

DOCUMENTATION

Early on in the project, a guiding set of documents took shape to help measure and catalog the testing. This made the testing effort organized and focused on results and provided a living library of the documents to help guide future network design changes or work arounds as an action plan when future outages occur.

The system test primarily used the following set of documents to plan, execute and record the system test effort. This effort produced a lot of data and information. The representations presented herein are for informational purposes only.

INdigital Standards and Practices (IS&P) – this document evolved from the system test guidance and concept documents. It includes the development of a naming convention resulting in an industry standard nomenclature for functional elements. The ISP clearly state the goals and objectives of any system testing and establishes the operating standards INdigital will use going forward when testing or performing maintenance on the IN911 System. [*The document itself is a confidential work product of INdigital and will not be reproduced as a part of this report.]* The table of contents is provided with permission and provides some insight into the document.

12-346 INdigital standards & practices (IS&P)

TABLE OF CONTENTS

Maintenance planner – this document serves as the comprehensive schedule and plan for maintenance testing each and every single element of the IN911 System on a regularly scheduled basis and to provide record keeping of such events. An example of the maintenance planner is provided below.

Carrier conections	***Annually***				
equipment common name	**CLFE code**	**Initial stress test date**	**date of last service**	**link to test plan**	**Link to results**
FTWY_SVI1	NG	*	11/15/2012	http://goo.gl/sylkP	
NWPR_SVI2	NG	*	11/15/2012	http://goo.gl/sylkP	
IPLSINZC3ED (.38)	NG	2/26/2013*		http://goo.gl/WHsLq	
Network Gateway NG	***Annually***				
equipment common name	**CLFE code**	**Initial stress test date**	**date of last service**	**link to test plan**	**Logs are located on L Drive**
330-EVVL-BA0821.1	NG	12/11/2012	12/11/2012	http://goo.gl/MTM05	L:\stresstesting\BA-Testing\821
330-SNTC-BA160.1	NG	12/11/2012	12/11/2012	http://goo.gl/MTM05	L:\stresstesting\BA-Testing\BA160
332-NWPR-BA20.1	NG	12/11/2012	12/11/2012	http://goo.gl/MTM05	L:\stresstesting\BA-Testing/BA20
332-NWPR-BA20.2	NG	12/11/2012	12/11/2012	http://goo.gl/MTM05	L:\stresstesting\BA-Testing/BA20
332-STCY-BA40.1	NG	12/11/2012	12/11/2012	http://goo.gl/MTM05	L:\stresstesting\BA-Testing\BA40
334-DCTR-BA0011.1	NG	12/11/2012	12/11/2012	http://goo.gl/MTM05	L:\stresstesting\BA-Testing\BA11
334-FTWY-BA30.1	NG	12/11/2012	12/11/2012	http://goo.gl/MTM05	L:\stresstesting\BA-Testing\BA30

INdigital work and safety plan (IWSP) - this document served as the individual test plan for each of the tests performed. An individual IWPS was developed for each of the functional test areas. Using January 8th as an example, there were 6 different IWSP documents governing the 6 tests performed that day. An example of the IWSP is provided below. This example does not reflect the entirety of an IWSP and is provided to show the kind of planning, information and documentation that was required during this system test.

13-023 ESRP Stress Testing IWSP

SECTION "A" - administrative

version:	13-023	work plan leader:	
summary of work :	Redeploy ESRP in new subnets/direct endpoint FE's to new address	safety plan leader:	
IWSP goal	Prove redundant connectivity and call delivery capabilities from ESRP-2 in Indy.	risk management: disruptive testing: alternative testing:	No

date of notice: 1-21-13		date of notice: 1-21-13	
internal notification list: Yes		external notification list: Yes	
method of notice: email		method of notice: email	
directly affected functional element:		All ESRP, PG and Associated endpoints	
indirect functional element:		All associated endpoints	
work leader	cell:	Skype:	physical location
	xxx-xxx-xxxx		INdigital office
active INdigital participants in the work plan:		casual INdigital participants:	
Neal		Brent	
Kent		Eric	
Mike		Steve	

manufacturer support:	No	[insert name and contact]
are direct eyes and hands at the FE location	yes	direct E&H census and contact information
person 1 + contact	person 2 + contact	person 3 + contact
are there third party eyes and hands at the FE location:	No	third party census and contact information
person 1 + contact	person 2 + contact	person 3 +contact
voice bridge: [yes / no]	Yes	PIN
Turbo Bridge	xxx-xxx-xxxx or xxx-xxx-xxxx	[do not use a confidential PIN in public facing documents]

voice bridge work introduction	"This work session {say title} at {say time in 24 hour format} on {say date} is being recorded, and this recording may be distributed as proof of our work today."	[confirm intro was recorded]
working in multiple time zones:	No	Eastern

Section "W" - work plan

proposed work date:	01-23-13
proposed start time:	05:00
email notification sent to involved parties	yes
send out calendar notification	yes
forecasted completion time:	08:00
forecasted work type:	[4] "5" = no service impact forecasted "4" = 'alarm in service' possible "3" = minor service impact possible "2" = major service impact forecasted "1" = critical service impact expected

-The remainder of this page is intentionally left blank-

System Test logs – the test logs captured the testing, failure and alternate processing of the IN911 System as the tests were being performed. In all, this system test generated thousands of pages of logs, an example test log is shown below

```
334-ANGL-PR0761.1(config-if)#
334-ANGL-PR0761.1(config-if)#
334-ANGL-PR0761.1(config-if)#
Jan 15 2013 09:28:21.363: %SYS-5-CONFIG_I: Configured from console by mrepp on vty1
(10.1.252.32)
334-ANGL-PR0761.1(config-if)#
334-ANGL-PR0761.1(config-if)#
334-ANGL-PR0761.1(config-if)#no shut
334-ANGL-PR0761.1(config-if)#
Jan 15 2013 09:28:57.810: %LINK-3-UPDOWN: Interface Serial0/0/0, changed state to down
Jan 15 2013 09:29:15.455: %LINK-3-UPDOWN: Interface Serial0/0/0, changed state to up
Jan 15 2013 09:29:16.008: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 334: Neighbor 10.30.253.1
(Serial0/0/0) is up: new adjacency
Jan 15 2013 09:29:16.457: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0,
changed state to up
334-ANGL-PR0761.1(config-if)#exit
334-ANGL-PR0761.1(config)#exit
334-ANGL-PR0761.1#un a
Jan 15 2013 09:30:11.355: %SYS-5-CONFIG_I: Configured from console by mrepp on vty0
(10.30.253.73)ll
All possible debugging has been turned off
334-ANGL-PR0761.1#wr mem
Building configuration...
[OK]
```

An example of notes captured during the ESRP testing done on 1/23/2013

Opened bridge @ 04:58
Placed pretest calls to Adams, Cass, Dearborn and Kosciusko @05:15
shutdown the ESRP registrar-1(Apache server) @ 05:17
shutdown ESRP-1 from accepting new calls @ 05:25
Placed test calls to Adams, Cass, Dearborn and Kosciusko to validate call routing through ESRP-2 in Indy @ 05:33
Started Monitoring mode via monitoring attempts on network and call flow @ 05:33.
Returned ESRP-1 to service @ 07:41

Cass County Audiocodes MP-114 needs to have an option for ESRP-2.
….. made changes to the Audiocodes to use the options to support the additional ESRP. Test calls validated call delivery

During monitoring a ticket…..was received from Whitley county having transfer issues to Kosciusko county. An analysis found that the conference bridge configuration did not include the ESRP-2. Remediation will take place to update the configuration……placed configuration in the bridge for ESRP-2. (Complete 1/23/13)

Noticed issues with calls coming from ….. Analysis found SVI configuration issue. ….. resolved the issue in SVI and test calls terminated as expected. (Complete 1/23/13)

THE RESULTS

The results of the system test can be discussed in three broad categories, they are:

1. The Expected results – what we thought would happen
2. The Unexpected results - what we didn't think would happen
3. System design or Process change items – when we saw it happen we thought about how to improve it

THE EXPECTED

Expected results are best described as what we expected the system to do when challenged and under stress. Predicting how it reacts, what it does to fix itself, when the expected alarms generate etc. and knowing why. These are the things we thought would happen when we did the system test.

The expected results of the system test are listed below:

1. Comprehensive system test is largely complete
2. The system operated as expected and as designed, calls were received, routed and delivered via the primary network, its components or via alternate means as provisioned
3. Overall institutional knowledge of the system was improved, how it operates, how it reacts under impairment and call load as well as what to do if something goes wrong
4. Areas of the system were identified that required configuration changes, but they were, by and large found, where we expected to find them
5. Modifications to the design of the system were made or realized which improved reliability and survivability of the system
6. Standards of operation were identified, developed and implemented
7. A Maintenance planner was developed which will ensure regularly scheduled activity for critical components in a more manageable form
8. Updated Diagrams and as builts
9. Improved record keeping

THE UNEXPECTED

These are the things that happened during testing that were not forecasted to occur. It should be noted that no severe or critical unexpected results were encountered during testing. By and large, the system operated as expected.

The most common unexpected result occurred in equipment at the edge of the network, at a point where the system has the most individual pieces of equipment, the outer boundary of the network at the PSAP connection. The most common cause of unexpected results occurred due to individual configurations or settings on individual pieces of equipment.

Some examples of the type of unexpected results we encountered are given below:

> *…… noted that the clock on ESRP 2 has the wrong time on it. It is off by an hour. ….will look at it to make sure that it has the correct time zone programmed. Upon checking he found that NPT was not installed…….*

> *While preparing to begin the testing,…. found that there was a static route that would have caused the testing to fail. It would have required manual intervention to fail. ……installing a weighted route to allow the traffic to fail over automatically if FE interface were to fail. The route had to be installed to both the BA and BR……*

> *…..duirng testing we found that the routing fail over took longer than we have seen on other devices….validated that fail over routing was in place. ….shut the interfaces down and validated that we maintained connectivity to the device. The routing failed over with*

In some instances, technicians were required to go hands on site to adjust the settings of a particular piece of equipment that was identified as not configured properly and or not behaving as expected during the system testing.

In the final analysis there were, thankfully, very few issues encountered that would warrant concern or identify a pattern of disregard for consistency or the implementation of industry standards.

SYSTEM DESIGN OR PROCESS CHANGE ITEMS

The items that generated a change in the design, operation or internal work flow process. This is best described as those items that upon seeing how it worked in the context of the entire system, precipitated a change in process or design

Some example areas with the most significant changes in this regard are:

- **Nomenclature** – standardizing the labeling, naming convention or creating a standardized reference point throughout the entire system. In some cases, this resulted in the re-cataloging of thousands of pieces of equipment, the testing provided an opportunity to review what was in the field and improve on the overall system of record and consistency of labeling and reference.

- **Power distribution** – how power is used throughout the system, how many devices are powered by the same circuits or power distribution units are examples where the system test generated inspection of devices outside the scope of the system test itself and resulted in a better operating posture than was present before the test.

- **Reduction of fault zones** (impacts from failure minimized) - this concept evolved as testing progressed, but is born from the notion that delayering the complexity of the network, and simplifying the design versus over sophistication, will reduce the number of elements that might be affected by the outage or impairment of another functional element.

- **Reallocation of the workload** - using a more balanced approach the system was rebalanced and is in a better operating posture.

- **A comprehensive operational maintenance schedule** - and testing plan was developed and institutionalized.

- **Increased system familiarity and understanding by support staff** – it cannot be overstated how beneficial it was for the staff that supports this critical system to go through this testing effort. The training and knowledge development are invaluable.

- **Processes improved and several new procedures were successfully implemented** - many of these have already been highlighted in this report, but the documentation examples given previously are excellent examples of this concept.

SYSTEM TEST SUMMARY

The system test itself was successful in meeting its objectives and establishing a better operational foundation. Inconsistent configurations were identified, standardization was accomplished, and a refreshed and improved understanding of the operation of IN911 was achieved.

It was good to step back from the day to day operation of the system and look at it through the different lens that system testing provided. This precipitated new thoughts and ideas for resilient design, redundancy considerations as well as a renewed focus on restoration and failure containment.

Overall, this was a very successful effort.

-The remainder of this page is intentionally left blank-

ANALYSIS OF THE IN911 SYSTEM

Having put the IN911 System through its paces, watched it operate in less than optimal conditions and gained an appreciation for the support elements of the system, an analysis of the IN911 System can be offered.

We will analyze the system in terms of:

- Operating Assessment
- Adherence to industry standard
- IN911s ability to adapt to future technology and standards changes

The NENA Technical standards used for comparison, referenced and cited for this analysis are listed below:

- 08-002 v1 - Func Interface StandardsNG91-1 (i3)
- 08-003 v1 - Detailed Func & Interface Specs (i3)
- 08-506 v1 - Emer. Serv. IP Network Design NG91-1

OPERATING ASSESSMENT

- **The system is in excellent operating condition and was improved by this testing**

  The general rule of thumb for most of the testing is that the IN911 System worked as expected and designed. Save for some aforementioned adjustments and minor configuration changes, the system is in sound operating condition and there is a high degree of confidence in the health and welfare of the IN911 System.

- **The system's ability to operate with impairment has improved and was validated by this testing**

  A resilient design results in a resilient system. Design refinements were adopted as a result of this system test. Those changes are proper and consistent with emerging industry standards and in some instances are actually serving as a benchmark for other efforts in the industry. The experience and 'lessons learned' are actively being shared in industry forums and with industry standards development efforts.

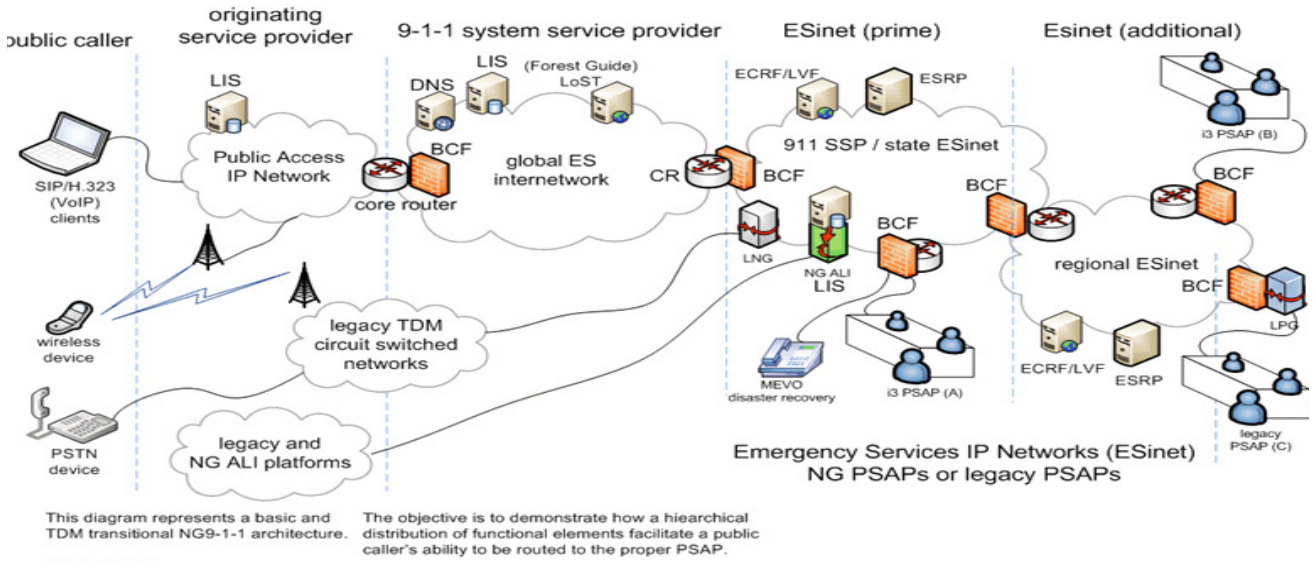
- **Institutional knowledge of the systems operation and design has increased and is better documented as a result of this testing**

  The IN911 System and those that support its operation are much better prepared to handle future outages than they were prior to this system testing effort. This increased preparedness can be directly attributed to the planning and coordination required to conduct the system testing on this breadth and scale.

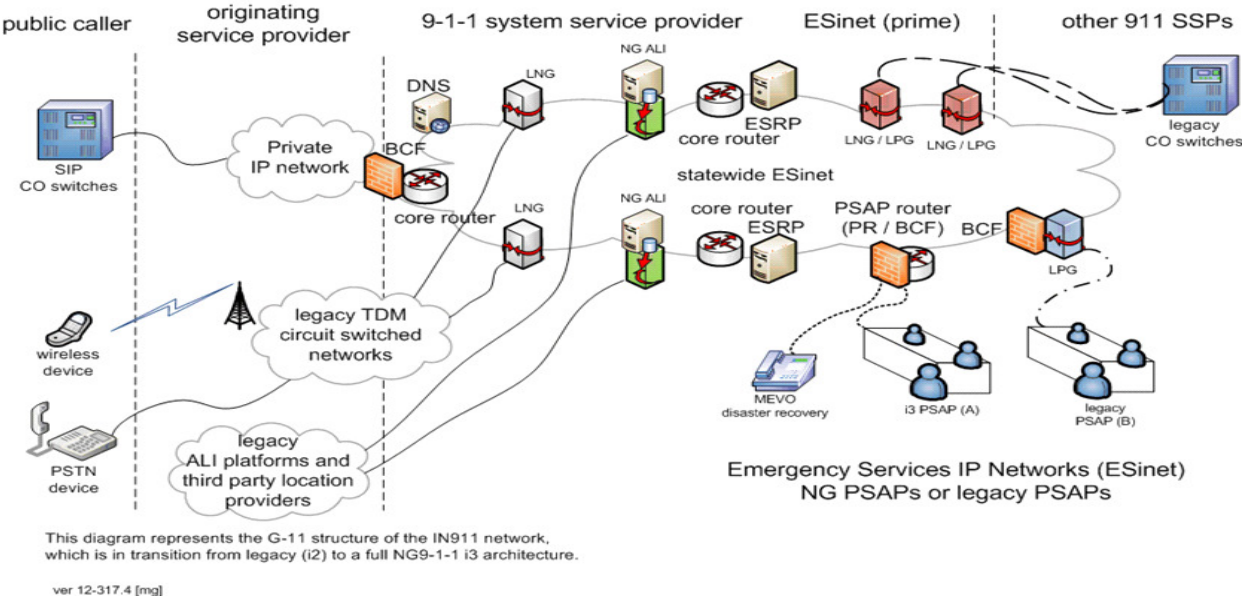
  Overall documentation of the system has been refreshed, improved upon and a living library of documents, diagrams and written procedures are available to serve the system in the future.

ADHERENCE TO INDUSTRY STANDARDS – COMPARISON TO NENA 08-003 i3 STANDARD

Due diligence requires that any analysis of the IN911 System would include a review of adherence to proposed and evolving industry standards and adherence to emerging technological direction. The NENA 08-003 i3 Standard, which is the current end state technical definition of Next Generation 9-1-1 set of standards that the 9-1-1 industry is moving to adopt, can be diagramed as follows and shows the major elements involved within the i3 environment.



The diagram below shows the current state of the evolution of the IN911 System. A comparison of the two diagrams reveals that while there are some differences, there are even more similarities.



The biggest difference between the two diagrams is that the NENA 08-003 i3 Standard envisions an end state (where things will be after a transition), while the IN911 diagram demonstrates a real world, operational state. The IN911 System must accommodate for the reality of where things are in the real world and maintain a tie to legacy systems.

BASIC TECHNICAL PRINCIPLES OF i3

An Emergency Service IP Network (ESInet)
The ESInet is the 911 call and data network that makes sure the call gets routed to the right place at the right time and with the right information. It can, in times of necessity become a network that can be shared by all public safety agencies involved in an emergency.

Does the IN911 utilize an ESInet?

Yes it does and in a manner consistent with industry standards and practices

Session Initiation Protocol (SIP)
SIP is a signaling protocol, the common language used to manage all aspects of the 9-1-1 call. It used to start, manage and end telephone and multimedia communication sessions over the ESInet. SIP signaling is used to send calls from the originating service provider (i.e. wireless carriers, VoIP carriers) to the PSAP, all calls entering the ESInet must be converted to SIP.

Does IN911 use SIP as envisioned by the i3 standard?

Yes it does and in a manner consistent with industry standards and practices

Dynamic Call Routing
The i3 architecture includes a significant change in how calls are routed to the PSAP. In NG9-1-1, the tabular MSAG is replaced with a geographic information system (GIS). Local GIS map data will be used for emergency call routing function (ECRF). The general concept is that real-time data is used to properly route the 9-1-1 call to the proper answering PSAP.

Does the IN911 System use i3 envisioned routing engines and requisite data elements?

Yes it does and in a manner consistent with industry standards and practices

Border Control Function (BCF) a/k/a Security
The BCF provides a secure entry point into the ESInet for emergency calls presented to the network. The BCF incorporates firewall, admission control, and may include anchoring of session and media as well as other security mechanisms to prevent deliberate or malicious attacks on PSAPs or other entities connected to the ESInet

Does the IN911 System incorporate i3 envisioned Border Control Functions?

Yes it does and in a manner consistent with industry standards and practices

ABILITY TO ADAPT TO FUTURE TECHNOLOGY CHANGES

- **The IN911 System has evolved with and is consistent with evolving industry standards, in some cases the IN911 System is setting the industry standard**

  A comparison of the IN911 System design to the NENA 08-003 i3 Standard specification reveals that the changes and evolutions of the IN911 System are consistent with these evolving standards and in some areas lead the industry due to practical knowledge and experience gained from years of actual operation.

  The very essence of the i3 standard was developed with adaptability, modularity with dynamic yet persistent connectivity in mind. All of these elements exist in the IN911 System.

  The IN911 System interfaces to and interacts with a wide variety of communications technologies. Much of the technology that connects to the IN911 System is legacy and single purposed. To facilitate wireless 9-1-1 calls from many different devices, placing calls from many different networks operated by many different commercial providers to the correct PSAP and do it successfully all across Indiana, is in fact a testament to the concepts and standards envisioned and developed by the Public Safety industry through member associations like NENA and APCO.

  INdigital as the operator of the IN911 System is duty and contract bound to stay current with emerging public safety technology and be proactive enough to ensure that the technology used to operate this critical service is among the best in the country.

  INdigital is current and active in public safety industry groups, standards development working groups as well as industry sponsored technology events (ICE). INdigital needs to remain engaged in these activities. By helping with the development of technology standards through industry working groups and sharing the lesson's learned from direct experience in operating a system like this INdigital is fulfilling its responsibility to properly operate the IN911 System.

  911 Authority found during this period of analysis that the changes made to the system over time, are consistent with adaptation to emerging public safety technologies and the IN911 System is about as current as a system like this should be.

-The remainder of this page is intentionally left blank-

SUMMARY

- The IN911 System test itself was very successful in meeting its objectives and establishing a better operational foundation for the IN911 System.
- Inconsistent configurations were identified and corrected, standardization was accomplished, and a refreshed and expanded understanding of the operation of the IN911 System was achieved. Overall, this was a very successful effort.
- It was good to step back from the day to day operation of the system and look at it through the different lens that system testing provided. This precipitated new thoughts and ideas for resilient design, redundancy considerations as well as a renewed focus on minimizing the potential impact from the failure of a functional element, improving restoration efforts and effectively communicating with stakeholders about system testing and failure containment.
- 911 Authority found that the IN911 System's ability to operate with impairment has improved and its design principals were validated by the IN911 System testing.
- 911 Authority found during this period of analysis that the changes made to the system over time, are consistent with the adaptation to emerging public safety technologies and standards like NENA 08-003 i3 Standard and further that the IN911 System is as current, as a system like this should be.
- 911 Authority found that the IN911 System is in excellent operating condition and was improved by this testing. The system operated as expected and the implementation of structured stress testing for the functional elements has played a key role in achieving the Board's goal to improve public safety.
- 911 Authority has a high degree of confidence in the health and welfare of the IN911 System, that does not mean it won't fail or have outages, it will, but the system itself as well as those who support its operation are better prepared to keep it in operation and restore it to operation in a timely manner should an outage occur.

-Nothing Follows-